PATENT
Attorney Docket No.: A7728/T48810
TTC No.: 16301-048810US
AMAT No.:
007728/USA/DSM/HDP/CVD/JPfeifer

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of:	Examiner: Rakesh K. Dhingra
SUDHIR GONDHALEKAR *et al.*	Art Unit: 1763
Application No.: 10/630,989	Confirmation No.: 7726
Filed: July 28, 2003	**APPELLANT'S BRIEF UNDER 37 CFR § 1.192**
For: GAS DELIVERY SYSTEM FOR SEMICONDUCTOR PROCESSING	

MAIL STOP APPEAL
BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants, in the above-captioned patent application, appeal the final rejection of claims 1-12 and 21-24. The claims on appeal have been finally rejected pursuant to MPEP § 706.07(b). Accordingly, this appeal is believed to be proper.

I. REAL PARTY IN INTEREST:

The real party in interest for the above-identified application is APPLIED MATERIALS, INC., a Delaware corporation having its principal place of business at 3050 Bowers Avenue, Santa Clara, California 95054. The assignment is recorded in the U.S. Patent and Trademark Office on July 28, 2003 at Reel 014359/Frame 0767.

II. RELATED APPEALS AND INTERFERENCES:

There are no appeals or interferences related to the present appeal.

III. STATUS OF CLAIMS:

Claims 1-12 and 21-24 are pending.

Claims 1, 4, 5, 8-10, and 12 stand rejected under 35 U.S.C. § 102(a) as being unpatentable over Japanese patent application Pub. No. 08-097188 A (Yoshida et al.) in view of Sanders et al. (US 5,120,930) and Vella (US 6,545,419).

Claims 2, 3, and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders et al., and Vella, and further in view of Japanese patent application Pub. No. 09-134880 A (Tsukune).

Claims 6 and 7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders, and Vella, and further in view of Narwankar et al. (US 6,200,911).

Claims 21-24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders, and Vella, and further in view of Whittaker (US 6,755,355).

IV. STATUS OF AMENDMENTS:

The claims on appeal have been finally rejected in the Final Office Action mailed on October 18, 2005. No further amendments were made.

In accordance with 37 C.F.R. § 1.192(c)(9), a copy of the claims involved in the appeal are contained in the Appendix attached hereto.

V. SUMMARY OF CLAIMED SUBJECT MATTER:

This application discloses a gas delivery system for a chemical vapor deposition chamber suitable for high density plasma gapfill processing and, more particularly, to a heat shield for a nozzle that extends into the chamber to introduce a process gas into the chamber.

In the embodiment of independent claim 1 as illustrated in Figs. 1 and 2, an apparatus for processing semiconductor substrates comprises a chamber 13 defining a plasma processing region 16 therein. A substrate support 18 is disposed in the chamber to support a semiconductor substrate 17. At least one nozzle 39, 40 extends into the chamber to introduce a process gas into the chamber through a nozzle opening. See paragraphs [15]-[16] at page 3, lines 24-31; and paragraph [29] at page 7, lines 5-16. Figs. 3 and 4 show a heat shield 100. Each heat shield is disposed around at least a portion of one of the at least one nozzle 102. The heat shield has an extension 120 which projects distally of the nozzle opening 106 of the nozzle 102 and includes a heat shield opening 114 for the process gas to flow therethrough from the nozzle

opening. The heat shield 100 is spaced from the nozzle 102 by a gap, which is smaller than a thickness of the heat shield 100. See paragraphs [31]-[33] at page 7, line 32 to page 9, line 5.

In the embodiment of independent claim 9 as illustrated in Figs. 1-4, a heat shield 100 is provided for shielding a nozzle 102 extending into a chamber 13 to introduce a process gas into the chamber through a nozzle opening. The chamber 13 defines a processing region 16 therein and has a substrate support 18 to support a semiconductor substrate 17 for processing in the chamber. The heat shield 100 comprises a hollow member configured to be coupled with the nozzle 102 and having an internal dimension sufficiently large to be disposed around at least a portion of the nozzle. The hollow member has an extension 120 which projects distally of the nozzle opening of the nozzle 102 and which includes a heat shield opening 114 for the process gas to flow therethrough from the nozzle opening. The hollow member is spaced from the nozzle 102 by a gap which is smaller than a thickness of the hollow member. See paragraphs [31]-[33] at page 7, line 32 to page 9, line 5.

In the embodiment of dependent claims 2, 3, and 11, the heat shield has a ceramic material, such as alumina or aluminum oxide, aluminum nitride, and silicon carbide. See paragraph [32] at page 8, lines 11-12.

In the embodiment of dependent claim 6, a plurality of nozzles 39, 40 are disposed around the substrate support 18 and each nozzle has a heat shield 100 disposed around at least a portion thereof. See Figures 1-4.

In the embodiment of dependent claims 21-24, the heat shield 100 may be a separate piece that is coupled to the nozzle 102, for example, by a threaded connection 110, or may be formed integrally with the nozzle. See paragraph [32] at page 8, lines 14-17.

VI. GROUNDS OF REJECTION PRESENTED FOR REVIEW:

A. Claims 1, 4, 5, 8-10, and 12 stand rejected under 35 U.S.C. § 102(a) as being unpatentable over Japanese patent application Pub. No. 08-097188 A (Yoshida et al.) in view of Sanders et al. (US 5,120,930) and Vella (US 6,545,419).

B. Claims 2, 3, and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders et al., and Vella, and further in view of Japanese patent application Pub. No. 09-134880 A (Tsukune).

C. Claims 6 and 7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders, and Vella, and further in view of Narwankar et al. (US 6,200,911).

D. Claims 21-24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders, and Vella, and further in view of Whittaker (US 6,755,355).

VII. ARGUMENTS:

A. Claims 1, 4, 5, 8-10, and 12 are not properly rejected under 35 U.S.C. § 102(a) as being unpatentable over Japanese patent application Pub. No. 08-097188 A (Yoshida et al.) in view of Sanders et al. (US 5,120,930) and Vella (US 6,545,419)

Claims 1, 4, 5, 8-10, and 12 stand rejected under 35 U.S.C. § 102(a) as being unpatentable over Japanese patent application Pub. No. 08-097188 A (Yoshida et al.) in view of Sanders et al. (US 5,120,930) and Vella (US 6,545,419).

Applicants respectfully submit that independent claim 1 is patentable over Yoshida et al., Sanders et al., and Vella because, for instance, they do not teach or suggest a heat shield for shielding a nozzle extending into a chamber to introduce a process gas into the chamber through a nozzle opening wherein the heat shield is spaced from the nozzle by a gap, and the gap between the heat shield and the nozzle is smaller than a thickness of the heat shield. This is described, for instance, in paragraph [33] of present application.

In contrast, the heat shield of Yoshida et al. is disposed so that the gap between the heat shield and the nozzle is significantly larger than the thickness of the heat shield. The design of the heat shield disclosed by Yoshida et al. is disadvantageous in that it occupies a larger volume within the limited confines of a semiconductor processing chamber, which can impede the processing of substrates due to spatial limitations. Furthermore, the larger volume occupied by the heat shield disclosed by Yoshida et al. causes poor heat dispersion by the heat shield in that the shield is closer to the substrate and the plasma formed within the chamber.

Sanders et al. discloses a plasma arc torch 10 with improved nozzle shield and step flow. The nozzle shield 38 is mounted at the lower end of the plasma arc cutting torch adjacent a workpiece to block splattered molten metal from reaching a nozzle 16 of the torch.

The shield 38 is spaced from the cap flange 20a and the nozzle 16 to define a gas flow passage 40, which allows gas flow to cool the shield 38 to a degree that inhibits the adherence of ejected molten metal. See Abstract; and column 6, lines 14-16 and 31-35.

Vella discloses a double chamber ion implantation system, in which a heat shield is positioned between the charge exchange chamber and the plasma generating chamber to reduce the temperature of the wall between the chambers thereby reducing thermal consumption of fuel introduced into the charge exchange chamber for ionization. See column 7, lines 39-44.

Applicants respectfully submit that Yoshida et al., Sanders et al., and Vella are non-analogous art. Sanders et al. and Vella are outside the field of Applicants' endeavor and are not reasonably pertinent to the particular problem that the inventors addressed. To determine if a reference may be properly relied upon to make out a prima facie case of obviousness, the inquiry is two-fold. The first inquiry is whether the reference is within the field of the inventors' endeavor. The second is whether the reference is reasonably pertinent to the particular problem that the inventors were trying to solve. *In re Clay*, 23 U.S.P.Q.2d 1058 (Fed. Cir. 1992); *In re Wood*, 202 U.S.P.Q. 171, 174 (C.C.P.A. 1979); *In re Deminski*, 230 U.S.P.Q. 313, 315 (Fed. Cir. 1986). In this case, the differences of the three references are summarized in the table below.

Comparison of Features	**Yoshida et al.**	**Sanders et al.**	**Vella**
Type of apparatus	Semiconductor processing chamber	Plasma arc torch	Double chamber ion implantation system
Nozzle usage	To introduce process gas into the chamber	To produce a pilot arc to electrode to initiate a plasma arc	N/A
Shield function	To shield the nozzle from heat	To block splattered molten metal from reaching the nozzle	To reduce the temperature of the wall between charge exchange chamber and plasma generating chamber
Gap characteristics	To provide a space between the heat shield and the nozzle	To define a gas flow passage which allows gas flow to cool the shield to a degree that inhibits the adherence of ejected molten metal	N/A

Applicants' invention relates to a heat shield for a nozzle used to introduce process gas into a semiconductor processing chamber. Yoshida et al. discloses a heat shield for a nozzle for a semiconductor processing chamber, but fails to teach that a gap between the heat shield and the nozzle is smaller than a thickness of the heat shield.

In contrast, Sanders et al. is directed to a plasma arc torch. The nozzle is used to produce a pilot arc to electrode to initiate a plasma arc, and the nozzle shield is used to block splattered molten metal from reaching the nozzle. The gap defines a gas flow passage which allows gas flow to cool the shield to a degree that inhibits the adherence of ejected molten metal. The plasma arc torch of Sanders et al. is outside the inventors' field of endeavor. Moreover, the usage of the nozzle shield to block splattered molten metal and the gap to allow gas flow to cool the shield is not reasonably pertinent to the particular problem that the inventors were trying to solve, namely, to shield the nozzle extending into the chamber from heat.

Furthermore, Vella discloses a double chamber ion implantation system in which a shield is provided to reduce the temperature of the wall between charge exchange chamber and plasma generating chamber. Vella is not directed to a shield for a nozzle. Clearly, Vella is outside the inventors' field of endeavor and its heat shield between two chambers is not reasonably pertinent to the particular problem that the inventors were trying to solve.

The design of the heat shield disclosed by Yoshida et al. is disadvantageous in that it occupies a larger volume within the limited confines of a semiconductor processing chamber, which can impede the processing of substrates due to spatial limitations. Furthermore, the larger volume occupied by the heat shield disclosed by Yoshida et al. causes poor heat dispersion by the heat shield in that the shield is closer to the substrate and the plasma formed within the chamber. Clearly, these are not problems addressed in Sanders et al. and Vella, and the presently claimed heat shield and gap are not features contemplated in Sanders et al. and Vella.

A person of ordinary skill in the art would not have expected the design of a plasma arc torch or a double chamber ion implantation system to have any bearing on the design of a heat shield for a nozzle for introducing a process gas into a semiconductor processing chamber. Therefore, Sanders et al. and Vella are not analogous to the problem Applicants sought to solve and cannot be properly relied upon in sustaining an obviousness rejection. The

combination of elements from nonanalogous sources, in a manner that reconstructs Applicants' invention only with the benefit of hindsight, is insufficient to present a prima facie case of obviousness. *In re Clay*, 23 U.S.P.Q.2d 1058 (Fed. Cir. 1992).

For at least the foregoing reasons, independent claim 1, and claims 4, 5, and 8 depending therefrom, are patentable over Yoshida et al., Sanders et al., and Vella.

Applicants respectfully assert that independent claim 9 is patentable over Yoshida et al., Sanders et al., and Vella because, for instance, they do not teach or suggest a heat shield for shielding a nozzle extending into a chamber to introduce a process gas into the chamber through a nozzle opening, wherein the heat shield includes a hollow member being spaced from the nozzle by a gap which is smaller than a thickness of the hollow member.

As described above, the head shield of Yoshida et al. is disposed so that the gap between the heat shield and the nozzle is significantly larger than the thickness of the heat shield. Sanders et al. and Vella are not analogous art and thus cannot be combined with Yoshida et al. to sustain an obviousness rejection.

For at least the foregoing reasons, independent claim 9, and claims 10 and 12 depending therefrom, are patentable over Yoshida et al., Sanders et al., and Vella.

B. Claims 2, 3, and 11 are not properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders et al., and Vella, and further in view of Japanese patent application Pub. No. 09-134880 A (Tsukune)

Dependent claims 2, 3, and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders et al., and Vella, and further in view of Japanese patent application Pub. No. 09-134880 A (Tsukune). The Examiner recognizes that Yoshida et al., Sanders et al., and Vella do not teach the material of the heat shield, and cites Tsukune for allegedly disclosing the missing feature.

Tsukune does not cure the deficiencies of Yoshida et al., Sanders et al., and Vella, in that it also fails to teach or suggest that the gap between the heat shield or hollow member and the nozzle is smaller than the thickness of the heat shield or hollow member, as recited in independent claim 1 and claim 9, from which claims 2-3 and claim 11 depend, respectively.

For at least the foregoing reasons, claims 2, 3, and 11 are patentable.

C. Claims 6 and 7 are not properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders, and Vella, and further in view of Narwankar et al. (US 6,200,911)

Dependent claims 6 and 7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders, and Vella, and further in view of Narwankar et al. (US 6,200,911). The Examiner acknowledges that Yoshida et al. does not teach a plurality of nozzles, and cites Narwankar et al. for allegedly disclosing the missing feature.

Narwankar et al. does not cure the deficiencies of Yoshida et al., Sanders et al., and Vella, in that it also fails to teach or suggest that the gap between the heat shield and the nozzle is smaller than the thickness of the heat shield, as recited in independent claim 1 from which claims 6 and 7 depend.

For at least the foregoing reasons, claims 6 and 7 are patentable.

D. Claims 21-24 are not properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders, and Vella, and further in view of Whittaker (US 6,755,355)

The dependent claims are patentable for additional reasons. For example, claim

Dependent claims 21-24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshida et al., Sanders, and Vella, and further in view of Whittaker (US 6,755,355).

Claims 21-24 depend from independent claims 1 and 9, respectively, and are submitted to be patentable as being directed to additional features of the invention, as well as by being dependent from allowable claims 1 and 9. Claim 21 and 23 recite that the heat shield is formed integrally with the nozzle. Claim 22 and 24 recite that the heat shield is coupled with the nozzle by a threaded connection. The Examiner cites Whittaker for allegedly disclosing the threaded connection as well as an integral design.

Whittaker does not cure the deficiencies of Yoshida et al., Sanders et al., and Vella, in that it also fails to teach or suggest that the gap between the heat shield or hollow member and the nozzle is smaller than the thickness of the heat shield or hollow member, as recited in independent claim 1 and claim 9, from which claims 21-22 and 23-24 depend, respectively.

For at least the foregoing reasons, claims 21-24 are patentable.

VIII. CONCLUSION:

In view of the foregoing arguments distinguishing claims 1-12 and 21-24 over the art of record, Applicants respectfully submit that the claims are in condition for allowance, and respectfully request that the rejection of these claims be reversed.

Respectfully submitted,

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Attachments: Appendices

CLAIMS APPENDIX

1. (Previously Presented) An apparatus for processing semiconductor substrates, the apparatus comprising:

a chamber defining a processing region therein;

a substrate support disposed in the chamber to support a semiconductor substrate;

at least one nozzle extending into the chamber to introduce a process gas into the chamber through a nozzle opening; and

at least one heat shield, each heat shield disposed around at least a portion of one of the at least one nozzle, the heat shield having an extension which projects distally of the nozzle opening of the nozzle and which includes a heat shield opening for the process gas to flow therethrough from the nozzle opening, the heat shield being spaced from the nozzle by a gap,

wherein the gap between the heat shield and the nozzle is smaller than a thickness of the heat shield.

2. (Original) The apparatus of claim 1 wherein the heat shield comprises a ceramic material.

3. (Original) The apparatus of claim 1 wherein the heat shield comprises a material selected from the group consisting of aluminum oxide, aluminum nitride, and silicon carbide.

4. (Original) The apparatus of claim 1 wherein the extension of the heat shield projects distally of the nozzle opening by a distance of between about a radius of the nozzle and about a diameter of the nozzle.

5. (Original) The apparatus of claim 1 wherein the heat shield is disposed around substantially the entire nozzle extending inside the chamber.

6. (Original) The apparatus of claim 1 wherein a plurality of nozzles are disposed around the substrate support and each nozzle has a heat shield disposed around at least a portion thereof.

7. (Original) The apparatus of claim 6 wherein the heat shields are disposed around the substrate support and configured such that the heat shield openings of the heat shields are disposed radially outwardly of a periphery of the semiconductor substrate.

8. (Original) The apparatus of claim 1 wherein the heat shield comprises a hollow, cylindrical member.

9. (Previously Presented) A heat shield for shielding a nozzle extending into a chamber to introduce a process gas into the chamber through a nozzle opening, wherein the chamber defines a processing region therein and has a substrate support to support a semiconductor substrate for processing in the chamber, the heat shield comprising:

a hollow member configured to be coupled with the nozzle and having an internal dimension sufficiently large to be disposed around at least a portion of the nozzle, the hollow member having an extension which projects distally of the nozzle opening of the nozzle and which includes a heat shield opening for the process gas to flow therethrough from the nozzle opening, the hollow member being spaced from the nozzle by a gap which is smaller than a thickness of the hollow member.

10. (Original) The heat shield of claim 9 wherein the hollow member is cylindrical and has an internal cross-section which is slightly larger than an external cross-section of the nozzle.

11. (Original) The heat shield of claim 9 wherein the hollow member comprises a ceramic material.

12. (Original) The heat shield of claim 9 wherein the extension of the heat shield is sized to project distally of the nozzle opening by a distance of between about a radius of the nozzle and about a diameter of the nozzle.

13.-20. (Canceled)

21. (Previously Presented) The apparatus of claim 1 wherein the heat shield is integrally formed with the nozzle.

22. (Previously Presented) The apparatus of claim 1 wherein the heat shield is coupled with the nozzle by a threaded connection.

23. (Previously Presented) The heat shield of claim 9 wherein the heat shield is integrally formed with the nozzle.

24. (Previously Presented) The heat shield of claim 9 wherein the heat shield is coupled with the nozzle by a threaded connection.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.

PTO/SB/17 (01-06)

Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2006

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) **500.00**

Complete if Known	
Application Number	10/630,989
Filing Date	July 28, 2003
First Named Inventor	Gondhalekar, Sudhir
Examiner Name	Rakesh K. Dhingra
Art Unit	1763
Attorney Docket No.	016301-048810US

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☒ Deposit Account Deposit Account Number: 20-1430 Deposit Account Name: Townsend and Townsend and Crew LLP

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☒ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayments

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FEE CALCULATION (All the fees below are due upon filing or may be subject to a surcharge.)

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
		Small Entity		Small Entity		Small Entity	
Application Type	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims		Extra Claims	Fee ($)		Fee Paid ($)
_____	-20 or HP =	_____	x _____	=	_____

HP = highest number of total claims paid for, if greater than 20

Indep. Claims		Extra Claims	Fee ($)		Fee Paid ($)
_____	-3 or HP =	_____	x _____	=	_____

HP = highest number of independent claims paid for, if greater than 3

Multiple Dependent Claims	
Fee ($)	Fee Paid ($)
_____	_____

3. APPLICATION SIZE FEE

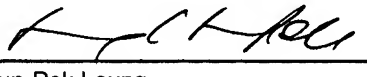
If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		Extra Sheets		Number of each additional 50 or fraction thereof	Fee ($)	Fee Paid ($)
_____	- 100 =	_____	/ 50 =	_____ (round up to a whole number)	x _____	= _____

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	
Other (e.g., late filing surcharge): **FILING A BRIEF IN SUPPORT OF AN APPEAL**	**500.00**

SUBMITTED BY

Signature		Registration No. (Attorney/Agent) 41,405	Telephone 650-326-2400
Name (Print/Type)	Chun-Pok Leung		Date June 14, 2006